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POTENTIAL
FEED GRAINS
UTILIZATION

LIBERIA - NIGERIA - SIERRA LEONE
AFRICA

A JOINT PROJECT OF THE
U.S. Foreign Agricultural Service, U.S. Department of Agriculture and the
U.S. Feed Grains Council

1961

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3⁰ **POTENTIAL FEED GRAINS UTILIZATION**

LIBERIA **NIGERIA** **SIERRA LEONE**

AFRICA

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FOREWORD

The Agricultural Trade and Assistance Act of 1954, as amended (Public Law 480) provides for the use of foreign currencies derived under such Act to help develop new markets for U.S. Agricultural commodities. The Foreign Agricultural Service is responsible for administering funds available under Section 104 (a) of the Act and the U.S. Feed Grains Team to Liberia, Nigeria, and Sierra Leone was a cooperative undertaking between the FAS and the U.S. Feed Grains Council under a Market Development Project Agreement for Feed Grains, as amended, dated January 27, 1961.

Representing the Foreign Agricultural Service and acting as coordinator for the team was John J. McCracken, Marketing Specialist (Grain), Grain and Feed Division, U.S.D.A., Washington, D.C. and representing the U.S. Feed Grains Council was Dr. J. Wayland Bennett, Head, Department of Agricultural Economics, Texas Technological College, Lubbock, Texas; Dr. John L. Milligan, Manager, Broiler and Roaster Research Division, Ralston Purina Company, St. Louis, Missouri and Mr. Taylor A. Cisco, President, American Liberian Development Corporation, Monrovia, Liberia.

In recent years as the economy of countries in the world have improved, human diets have changed to the extent of including greater amounts of animal proteins. In common with many other developing countries in the world, the people of Africa are suffering from an unbalanced human diet with inadequate amounts of animal proteins. To offset these inadequate amounts of animal proteins, there is a trend in the world and in Africa to increase the production of livestock and poultry products. The phenomenal growth of world production and trade in poultry meat is one of the remarkable developments of the post-war period and is of special significance in that it has helped make more high protein food available to consumers at reasonable prices. Although not universal, the increased output has been widespread and indications point to continued growth in all areas, old as well as new.

It is to the best interest of U.S. producers of feed grains to stimulate this trend which represents the most immediate potential new market for our abundant supply of feed grains. This was the major reason for this study.

The Agricultural Attaches, representatives of the International Cooperation Administration, the American Embassies and foreign trade and Government representatives in the countries visited, were extremely helpful in contributing to the success of the team's visit to Africa. For this assistance and cooperation, the team takes this opportunity to express its appreciation. It also believes that the exchange of team visits of this kind will do much in furthering the marketing of U.S. agricultural commodities and the understanding of people in the world.

OBJECTIVE

(1) To study the needs and local plans in Liberia, Nigeria, and Sierra Leone for increasing animal protein in the human diet. (2) To relate such needs to the potential utilization of feed grains. (3) To study and make recommendations concerning the feasibility of U.S. assistance in the development of livestock and poultry production, processing, marketing, and the manufacturing and distribution of balanced mixed feeds.

S U M M A R Y

LIBERIA

Population approximately 1.75 million with the most densely populated area being in the vicinity of Monrovia, the capital city. Caloric intake is reasonably adequate with rice being the favorite food. In common with the rest of Africa, the Liberian's diet is high in starches and low in proteins. Liberia has only a moderate degree of self-sufficiency in foods with large quantities of rice and other foods being imported. The port of Monrovia, being a free port, could offer some possibilities as a terminal point for the distribution of U.S. feeding stuffs and other food supplies.

NIGERIA

This country has the largest population in Africa which is estimated at about 38-40 million people. Food supplies are fairly adequate with about 80 per cent of caloric intake obtained from starchy root crops and grains. Animal proteins for human consumption are inadequate and the local government, with the assistance of the I.C.A. and United Kingdom representatives, is striving to develop livestock and poultry production.

SIERRA LEONE

Population estimated at approximately 3 million. Food production is barely adequate with the human diet high in starches and low in animal proteins, with a «hungry season» coming just before the rice harvest. To offset the inadequacy of animal proteins the British are encouraging the production of poultry and swine products with this program being in the early initial stages. The I.C.A. is developing a program to further encourage this development.

R E C O M M E N D A T I O N S

The U.S. Feed Grains Team to Africa, based upon information and data in the General Findings section of the report, recommend the following:

A. Adequate Feed Supplies

While carbohydrate supplies are approximately adequate for human needs, there are at present no supplies available for commercial livestock production. The U.S. has an abundance of feed grains, i.e. corn and grain sorghum and it is believed that they can be used to provide the required feed supplies under existing government programs without further action of Congress. The credit program under Title IV Public Law 480, or grants of feed supplies could be used as vehicles to further the development of livestock and poultry production. It is recommended that corn, grain sorghum, and complete manufactured mixed feeds be made available to the countries under consideration through these programs.

B. Growth Capital

Facilities for the storage and distribution of feed supplies, feed manufacturing, livestock and poultry production, processing and marketing are inadequate. Growth capital is hard to obtain for livestock and poultry production and related facilities. It is recommended that to secure the necessary growth capital, it is essential that funds generated by agricultural commodities provided under U.S. credit and grant programs be used for further developing livestock and poultry production and to construct related facilities.

C. Technical Assistance

Assistance directed to commercial livestock and poultry producers and related industries is essential. This can be provided by ICA, FAS, U.S. trade cooperators and Peace Corps representatives. Technical assistance programs administered by U.S. government agencies must be carefully coordinated for maximum efficiency. It is recommended that U.S. feed manufacturing companies and local business interests (with full support of local governments) be encouraged to jointly develop adequate mixed feed supplies, and other necessary supporting services for a local livestock and poultry industry.

D. Proposed Pilot Project Outline

This proposal is intended for those developing countries that can meet the criteria for credit under Title IV, Public Law 480. Data obtained by the team indicate that Nigeria, of the three countries visited, probably offers the best opportunity for such a project.

1. A Title IV, Public Law 480 Credit program should be established for the foreign country with provisions that funds generated be used to help establish grain storage, feed manufacturing, livestock and poultry production, and processing and marketing projects.

2. The foreign Government should be encouraged to invite the participation of a U.S. feed manufacturing firm in such a project through a contract or partnership with local interests under a favorable business arrangement utilizing funds accruing through the U.S. credit program. In the initial development stage, such operations will probably be necessarily unprofitable. These funds could be used to establish supporting facilities to aid participation by the U.S. foreign business interest with such interest providing other funds. Examples of supporting facilities might be the building site, warehousing, or dock siding.

3. *Technical Training Program*

Under the U.S. Foreign project, a practical program of training nationals in the U.S. in commercial livestock and poultry practices and related operations should be established. U.S. technicians from ICA, FAS, Peace Corps and Trade cooperators could be used to support the operations of the project through on-the-spot training to local people.

GENERAL FINDINGS

LIBERIA Population

The population estimates for Liberia range from a low of 750,000 to a high of 2,000,000. The Embassy believes a population estimate of 1,000,000 is approximately correct, however, the Liberian government officially estimates the population at 1,750,000.

The capital city of Monrovia is by far the largest city, with a population of approximately 50,000 when the surrounding suburban areas are included. The official estimate of the government is that a third of the Liberian population lives in Monrovia and the territory lying in a 50-mile radius thereof. Most of the principal agricultural and industrial activities at the present time are concentrated in this area. The only other population centers of any size, ranging between 5,000 and 10,000, are the port cities of Harper and Buchanan; Vaitown, situated near the iron mine at Bomi Hills; and Gbanga and Kakata in the Central Province.

General Economy

The general economy of Liberia, until recently, has been based almost entirely on subsistence farming, except for the production of rubber and a few less important agricultural crops for export. Rubber as a leading export item is followed closely by iron ore in dollar value with diamonds a distant third in export value. However, as plans for the development of three new iron ore mines progress, iron ore dollar exports will, by the mid-1960's, far exceed all other products in export value. Geological surveys currently in progress tentatively indicate the strong possibilities of deposits of other minerals of significant commercial potential.

During the past ten years, the Liberian economy has been expanding and diversifying. The major growth has been in the minerals area; however, because of a rather liberal investment policy, additional foreign investment capital has been attracted to the country. The government has undertaken development programs whereby roads, power, communications, and other essentials of a modern economy are being extended and improved. A limited development has been witnessed in small scale manufacturing industries that produce for the local market; and there has been a widespread interest, as yet not of commercial importance, in the development of Liberia's almost untapped timber resources.

While data relative to the GNP of Liberia are very sketchy, there has been an increase from 51 million in 1942 to 130 million in 1958 (in 1958 dollars); and primarily based on anticipated developments in iron ore, this figure is estimated by the economic staff of the American Embassy and USOM/Liberia to exceed 300 million within ten years.

The following table further indicates the growing economy of Liberia as indicated by both the increase in government revenues and the source of these revenues during the past nine years.

Table I. Trend in Liberian Revenues, 1952-60
(Millions of US Dollars)

<i>Year</i>	<i>Internal</i>	<i>Customs</i>	<i>Other</i>	<i>Total</i>
1952	5.45	2.70	.71	8.85
1953	7.49	2.72	.99	11.20
1954	7.48	3.06	1.38	11.92
1955	10.15	3.34	1.82	15.30
1956	11.71	3.90	2.31	17.92
1957	12.52	4.51	3.10	20.13
1958	10.51	5.03	2.57	18.11
1959	15.29	6.81	2.46	24.55
1960	23.38	7.52	2.48	32.37

Government revenue collections for the first two months of 1961 were at an all-time high. Collections for January and February of 1961 reached a total of \$ 5,785,833.00.

A further study of the Liberian economy compiled by an Embassy/USOM study group projected the Gross National Product and Liberian government's revenues to 1970. These projections are shown in Table II.

**Table II. Projection of Gross National Product
and Government of Liberia Revenues, Selected Years, 1960-70**
(\$ 1,000,000)

<i>Year</i>	<i>GNP a/</i>	<i>Revenues b/</i>	<i>Revenues as a Percent of GNP c/</i>
1960	116	32.4	27.9
1961	125	35.0	28.0
1962	140	39.0	28.0
1963	152	43.0	28.0
1965	189	53.0	28.0
1968	265	75.0	28.0
1970	357	100.0	28.0

a) Figures for 1960-68 are Embassy-USOM projection based on the very tenuous statistics now available. Figure for 1970 calculated by dividing assumed revenues of \$ 100 million by 0.28, the ratio of revenues to GNP in 1960.

b) Figure for 1960 is actual revenues; for 1961, estimate of Bureau of Economic Research; for 1962-70, obtained by multiplying projected GNP by 28% (ratio of current revenue to GNP in 1960).

c) Figure for 1960 is actual, and for 1961 based on ratio of estimated revenue to estimated GNP. Ratio of revenues to GNP in 1962-70 assumed to remain constant at 28%, the ratio in 1960.

These projections of an increased GNP for Liberia are based on currently active development projects, especially in the iron ore mining industry. With at least a third of a billion dollars now, or soon to be, invested in its iron ore mining industry, Liberia seems destined to become one of the world's major iron ore producing countries. It is conceivable that Liberia may be shipping more iron ore in 5-10 years than any other country in the world.

Capacity of present facilities, and projects underway, may reach an annual output of 22 million long tons of high grade ore per year. Actual and planned capacities of iron ore producers in Liberia are estimated as follows:

Table III. Potential Iron Ore Production, Liberia

<i>Firm</i>	<i>Capacity (Long tons per Year)</i>
Liberia Mining Co. (LMC)	3,000,000
Liberian American-Swedish Minerals Co. (LAMCO)	6-10,000,000
German Liberian Mining Co. (DELIMCO)	5,000,000
National Iron Ore Co. (NIOC)	4,000,000

Total 18-22,000,000

If an average value of \$ 10-12.00 (F.O.B. Monrovia) is assumed, expected shipments would be valued at nearly a quarter billion dollars annually — an impressive industry from which to draw revenue. Reserves, currently not fully examined, are adequate to maintain this rate of output for many years and further expansion will depend primarily on world marketing conditions.

Liberia Mining Company (LMC) as yet is the only producer exporting, producing from the Bomi Hills area, has achieved a relatively stable output of about 3,000,000 tons per year. High-grade ore, running 68 to 70 per cent iron, has been estimated at 50 million tons. Total reserves, including low-grade ores, have been estimated at 300 million tons.

The Liberian-American-Swedish Minerals Company (LAMCO) holds the concession for the Nimba Range near Sanokole in the Central Province of Liberia along the Guinea border. Preliminary estimates indicate that this deposit contains several hundred million tons of commercial exploitable ore. Core drillings indicate proven reserves of over 200,000,000 million long tons of ore assaying 60-70 per cent iron content. LAMCO is 50 per cent owned by the Liberian Government, and any substantial developments in iron ore substantiate the preceding estimates of increasing government revenues. This revenue can be used in many ways by the government to institute growth capital for increased economic development. LAMCO also holds concessions on two other possible commercial producing iron ore deposits and currently plans to develop these.

The Nimba Range project involves the construction of a 165-mile standard guage railway from Mount Nimba to the coast at Buchanan where an ore shipping harbor is being constructed. Also, it is planned to develop an all-weather road from the mine area to Buchanan.

The National Iron Ore Company (NIOC) is about on schedule in developing the Mano River iron ore deposits in the extreme western part of Liberia. The company has been laying rails on a 50-mile extension of the railroad currently serving the Bomi Hills deposits. This mine is expected to be in production by 1963 with an annual output of 4,000,000 tons of ore. Reserves are estimated at 50 million tons, but are probably much larger. The Liberian government has an approximate 25 per cent owership in this project (This concession is held by the National Iron Ore Company, 50 per cent government owned; 15 per cent by Liberia Mining Company; and 35 per cent by private investors.)

The other deposit currently being developed is located in the Bong Range about 60 miles northeast of Monrovia. This development is being constructed by the German-Liberian Mining Company (DELIMCO) and should be in operation in 2-2½ years. The company plans to construct a railway 60 miles long and to develop a new ore-loading pier at the Free Port. Although core drilling is not complete, company officials indicate that reserves are at least 200 milion tons. This concession will also be 50 per cent owned by the Liberian government.

Level of Employment

Liberia's major economic problem remains that of human development. It is quite apparent that both the government and private industry are becoming increasingly constricted by the lack of trained manpower with the technical skills required to fulfill the general economic development and increased material well-being promised by the expanding economy.

Embassy and USOM/Liberia personnel estimate that currently 75 per cent of Liberian families are in the subsistence level of the economy. That of Liberia's total population, no more than 80-100,000 people are in the money economy. This includes the members of the families of wage earners or of cash crop indigenous farmers.

The Liberian government recently passed national minimum wage rates for unskilled workers, setting the rate at 10 cents an hour for unskilled industrial workers and 6 cents an hour for unskilled farm workers. In comparison, skilled workers, i.e. mechanics, bricklayers, carpenters, heavy equipment workers, etc., earn from \$ 40 to \$ 100 a month. Average per capita income of Liberia is currently estimated to be less than \$ 200 a year which leaves a large share of the population outside of the money economy.

Firestone is the largest employer in Liberia using a work force estimated to be between 20-25 thousand. Goodrich goes into production next year on a much smaller scale, and will need 2 to 3 thousand full-time employees. LAMCO is developing a city of 10,000 at its Nimba Range mine, and this will attract many others to the area as Vaitown (Bomi Hills) did. This growth will also be felt in the port city of Buchanan as the iron ore begins to flow to market. Lesser growth in employment will be experienced at the Mano River Range (NIOC) and at the Bong Range (DELIMCO) iron ore mines.

All of the people consulted stressed that one of Liberia's major problems is a dearth of trained people. To overcome this, the government is stressing increased aid to education. Educational facilities are being increased as rapidly as possible and especially in the rural areas. While this is a «bootstrap» type of operation at present, it will eventually increase the available labor supply of the technically trainable.

The Liberian government spends about \$ 2 million annually, or about 10 per cent of its total expenditures, to operate its educational program. Additional funds expended by the Liberian government for school construction together with assistance received from the United States International Cooperation Administration (ICA) and UNESCO and the expenditures of missions and private groups probably aggregate another \$ 2 million annually.

It is to be expected that as government revenues increase, as projected to 1970, that increasing amounts will be expended on education which will act as a multiplier on the economic development of the country.

Additional help in the educational improvement in Liberia may be forthcoming. Amounts corresponding to lend-lease payments may be used for education in Liberia. This amount could approximate \$ 19 million. To further stress the importance of education in Liberia's economic development, more than 1000 adults registered for literacy courses during 1960, and 300 successfully passed their examinations and received literacy certificates.

Transportation and Market Facilities

The present transportation system and market facilities are pathetically inadequate. The rapid development in both of these areas is essential if Liberia is to experience any substantial growth in its movement of commodities to and from ports of export and import, as well as for the internal movement of domestic foodstuffs and other produce.

The Liberian government realizes that the construction of a national highway system is basic to any future economic development. It is proposed that a basic network of 1,600 miles of improved roads be in operation by 1965. This highway transportation system is considered necessary for the development of known natural resources and for the implementation and execution of agricultural and social programs. When the various projects are completed, they will provide interconnecting road access to all major areas of Liberia as well as with Guinea, the Ivory Coast, and Sierra Leone.

In addition, to facilitate the opening up of more agricultural land, a farm-to-market road program has been initiated by the Liberian government with ICA financial assistance. It is expected that additional highways will be built by iron mining companies to provide access to their facilities. All of these increase the potential agricultural and market developments in Liberia.

The only railroad operating in Liberia at the present is owned by the Liberia Mining Company. In addition to the iron it hauls, it handles approximately 2,500 tons of general freight per month. It is to be expected that the railroads to be built at the other mine areas will also haul much of the freight for their own use.

Free Port

The free port is presently inadequate to efficiently handle the volume of traffic calling on it, both from the standpoint of dockage area and warehousing facilities.

The wharf area is 2000 feet long and is presently used as follows: The Liberian Mining Company uses 750 frontage and 1,250 front feet is used by the Port Authority. Thus, the free port has berthing facilities for two to three large cargo ships. On January 1, 1962, the free port hopes to occupy the 750 frontage now used by the Liberian Mining Company, thereby actually doubling their space by permitting them to handle four cargo size C-2's at the same time. The port also is increasing its warehouse space by taking over (July 15, 1961) a warehouse currently used by Firestone.

The director of the port indicated that bids are currently being taken to enclose two large open warehouses and to repair the warehouse destroyed by fire in March of this year.

Additional plans call for additional warehouses to be built in 1962 and long range plans for additional finger piers for berthing, a fuel jetty, a fishing fleet jetty, and a grain storage area that will be situated 400-500 feet away from the wharf area.

At the present time, facilities for handling commodities efficiently are inadequate as evidenced by a recent record 19-day waiting period in the harbor before docking.

Another 24-foot draft harbor is close to completion at Sinoe, across the river from Greenville. It is expected to be used to export rubber and other forest and mineral resources and for necessary imports. The harbor at Buchanan is expected to have a 40-foot draft to handle the iron ore shipments from the Nimba Range; however, other exports and imports can also be accommodated here.

Foreign Trade

Liberia is unique in Africa in that its foreign trade is primarily with the United States. However, in recent years the trade with Western Europe has increased, but the percentage done with the U.S. has remained relatively stable. Liberian exports are concentrated chiefly in rubber and iron ore, while imports involve a wide range of goods. The rapid rise in import during the past 10 years is a reflection of the economic growth stimulated by increased foreign investment and government spending. A major factor in the increased imports is the large amount of machinery and transport equipment being imported in connection with the Mano River mine and railroad, and the LAMCO railroad and port. In 1960, the balance of trade was still highly favorable with exports being valued at approximately \$ 83 million and imports at \$ 69 million.

The internal marketing channels at the present are not highly developed. Internal trade is conducted by various techniques including barter, the trading post, and trading firms located principally in Monrovia with branches in other principal towns. The trading firms generally

carry on both import and export trade, distribution at wholesale and retail, and purchasing from small traders or producers.

Land Tenure and Credit

The prevailing land tenure system in Liberia is similar to the other African countries. The land is held for communal utilization and is usually owned by the chief. This has been a deterrant to the incentive of the individual to practice proper soil management, to make permanent improvements, or to use the land as collateral.

There is insufficient credit available to enable Liberian farmers to make the best use of their labor and natural resources. It is obvious that before the credit needs of the farmer can be adequately met, methods and procedures must be legalized so that lenders may have a means of recovering their loan in case of default.

AGRICULTURAL ECONOMY

Climate and Soils

The climate is tropical and humid. Temperatures remain uniform throughout the year with an average daily mean of 80° F. for the entire country. Yearly rainfall averages from 150 to 170 inches but may exceed 200 inches along the coast. Some areas farthest inland have a decrease in amount to about 70 inches yearly.

The soils of Liberia represent a number of soil classes classifiable as sandy clay loams, clay loams, and on rolling and hilly land, usually gravel loams. The soils are very porous and are subject to heavy leaching.

The soil condition and the climate make Liberia better adapted to a tree-crop agriculture than to annual field-crop production.

Crop Production

Of the total land area, approximately 50 per cent is considered arable. About 2 million acres, occupying the valley floors and seasonal swamps, are suited to cultivation of annual feed and food crops, such as rice, cassava, maize (corn), and various kinds of vegetables, about 5 million acres, occupying the lower foot slopes, are adapted to tree crops. The remaining land, exclusive of wasteland and that taken up for townsites and roads, is expected to be retained in permanent forest.

Except for plantations operated by foreign concessionaires and well-to-do Liberians, the agriculture is largely primitive. Modern farm machinery is virtually unknown; no horses or other work animals are used. Work tools are the machete, the hoe, and occasionally an ax.

Overshadowing all other operations in the agricultural field is the 90,000-acre Firestone rubber plantation. The smaller B. F. Goodrich plantation has about 10,000 acres of rubber trees planted and expects to be in operation within a year or two. Rubber is the most important export crop; others are palm kernals, coffee, cocoa, and piassava (palm fiber).

The two principal crops produced by the indigenous farmer are rice and cassava; others palm oil, yams, plantains, bananas, and pineapples, and other food crops.

Food production in Liberia is not adequate to meet the needs of its population. The caloric intake of 2,540 calories per day (1958 estimate) is reasonably adequate. Rice, cassava, palm oil, yams, and sweetpotatoes are the basic foods consumed by Liberians. Very little protein is found in the Liberian diet and in 1958, the daily consumption of animal protein was estimated to be 3 grams. In the table below is the area and production of principal crops for Liberia in 1956.

Liberia: Area and Production of Principal Crops, 1956

<i>Corn</i>	<i>Area</i>	<i>Production</i>
	1,000 Acres	1,000 Metric Tons
Rice (Milled)	260.2	111.8
Rubber	40.6	40.1
Rubber, immature	55.9	—
Cassava	48.6	365.8
Coffee	9.3	1.0
Sugar Cane	8.1	203.2
Bananas	6.1	61.0
Cocoa	5.7	.8
Palm Oil	—	41.1
Palm Kernals	—	10.0

In 1958 Liberia imported approximately \$ 6,000,000 worth of foods, beverages, and tobacco, and this had increased to over \$ 11,000,000 in 1960. Data are unavailable as to the dollar value of eggs and meat products imported, but from all indications, these had a greater percentage increase than did the average for all foods.

LIVESTOCK AND POULTRY

Introduction

Liberia has a small, expanding commercial poultry industry but virtually no other livestock. Eggs, particularly, are in great demand but high cost prevents many people from eating them. There is a little interest in broilers, but relatively speaking, the latter type of poultry production is in its infancy. There is a sense of urgency in the government concerning its need to support the poultry industry. The Secretary of Agriculture and other key people emphasize the government's interest in having a feed manufacturing plant established in Liberia. This emphasis persists despite grave ingredient supply deficiencies. They feel it will be helpful both in developing the Liberian poultry industry and in stimulating local production of feedstuffs.

Production of Meat and Eggs

The hatching capacity is 12,500 eggs per week, considerably in excess of the present requirement for about 2500 chicks per week. The American, Le Tourneau, has in his development at Baffu Bay, a Robbins Incubator which holds 30,00 eggs. Most of the remaining capacity in Liberia is owned by an American Negro expatriate, Mr. Stewart. He has 7500 egg capacity in old Humidaire Incubators, midway between Monrovia and Suakoko, the central Experiment Station in Liberia.

Breeding

Le Tourneau has introduced Babcock laying a and Hubbard broiler strains. There are some Sunnybrooks and some White Rocks at Dr. Baker's place near Cuttington College. Also, Stewart has a small Leghorn breeding flock and some New Hampshire breeders. At present, the Central Experiment Station is endeavoring to «breed up» native stock. Breeding at Firestone is Kimberchix, imported, of course, from the U.S..

Bird Population

In Liberia there are now approximately 42,600 commercial layers, 3,000 broilers, 1,000 breeders, and 4,500 replacement birds. Some of the commercial layers are used also as breeders when needed. It is estimated by a cold storage operator in Monrovia that five to six hundred cases of table eggs are imported per month in addition to the eggs supplied by their local birds. This is equivalent to the production of an additional 5,000 commercial layers. They are being imported currently from Casablanca because American paper cases are unsatisfactory during the rainy season. The Casablanca eggs come in wooden crates.

This same source (Monrovia Cold Storage), which is the only wholesale cold storage operator in Liberia, estimated broiler and meat importation to be 15 to 20 thousand pounds per month. This meat is coming from Esskay, in Baltimore, from Swift, and from suppliers in Europe. The biggest local source of poultry meat is Le Tourneau, who supplies eviscerated birds with heads and legs off, at the weight of 2 to 2½ pounds each. Birds are costing 29¢ per pound in the U.S. with 7¢ per pound added for freight and 12¢ per pound duty, which is set on the basis of 40% of the price of the poultry, apparently in the States. This makes a total of 38¢ per pound for broilers. If broilers are imported from Europe, they cost 58¢ per pound in Europe at present. Eggs cost \$ 27.00 per case laid in at Monrovia, including a duty of 40½ and sell for \$ 29.00 wholesale. The duty has amounted to 25¢ per dozen.

Management

Except for Firestone and Le Tourneau, housing is nondescript, mostly of cheap U.S. style. Chicken wire is used above several courses of cement block. Houses are one to two stories high. Gable roofs of galvanized metal are used. In one case, no nests were provided for the laying flock. Dr. Baker has just commenced operation of a cage laying flock under somewhat better management conditions. At Firestone and Le Tourneau, housing and management were superior and equal to good operations in the States, except housing was unusually permanent in style. Stewart, the broiler producer, had some Sunshine Porches for broilers.

Sanitation

Sanitation was rather poor. Birds were being vaccinated against Newcastle disease (Vine-land 717 web type) and Terramycin is used for injection purposes. At the Suakoko Central Experiment Station, simple diagnoses can be made. No culturing is possible due to lack of knowhow. The diagnosticians attended the School of Veterinary Medicine in Nigeria. Dr. Christian Baker (D.V.M.) is the best qualified man in Liberia but he is now Head of Cuttington College and Divinity School and has little time for such work. Sleeping sickness is no problem in poultry in Liberia. Firestone personnel considered Dr. Weyer, Entomologist with that firm, as the best laboratory diagnostician in Liberia. The feed dealer at Kakata, Mr. Mostellar, is reported to be good as a field diagnostician.

Bifuran is used as a preventive coccidiostat in some imported feed. Supervision is poor from National operators who are frequently absentee landlords. Firestone and Le Tourneau provide good supervision.

FEED SUPPLIES

Availability of Local Ingredients

Very few local ingredients are available and none of those in accessible commercial quantities. Cassava could be produced in much larger quantities, but a mill would have to be constructed for its processing. Production now is on a subsistence basis for human use only. Corn is very poor in quality. Yams and cocoa yams and bananas offer dim prospects as carbohydrate sources. There are no protein supplements produced locally. Peanut meal might be imported from Nigeria.

Mixed Feeds

There is no local production of mixed feeds. Commercial feeds are imported from Europe or the U.S. Suppliers are Vitamealo of the U.K., Pillsbury, Quaker and Purina. There are at present no import restrictions on ingredients or mixed feeds. This would probably be altered if local feed mixing were to develop, to protect domestic industry.

Commercial growers are organized in a poultry association. They would greatly welcome provision of a steady, reliable supply of high quality feed. The situation has improved somewhat recently with more regular shipments of Vitamealo. In the past, growers have from time to time been forced by shortages to use corn or rice only, adversely affecting production. Rice is not imported from the U.S. because of price, but from Burma or Italy. Chicken laying and growing feeds are provided. Most orders for five to ten bags, ten bags every fortnight. Prices of ingredients are somewhat high: local corn - \$ 80.00 per short ton currently, but there is no local corn at all for four months of the year. The price of Chick Grower pelleted is \$ 130.00 per short ton, based on Vitamealo prices.

There are two feed importers at Monrovia besides the American Liberian Development Company and one at Kakata (Mr. Mostellar) which is about fifty miles inland from Monrovia. The latter is the most active one since he is the only one currently supplying any service to the grower.

Mixing Facilities

There are no facilities for mixing feed except for an unused 300 pound capacity mixer owned by Mr. Stewart. Dealers have limited warehousing capacity suitable for handling perhaps 250 bags a month or 12½ tons. There are no reserves of local raw materials and no facilities for such. All imported ingredients and feeds are handled in 100 lbs. bags. The free port at Monrovia is incapable at present of handling shipping tonnage efficiently.

Present Feed Requirements

At present statistics on numbers of birds are quite inadequate. The team was forced to develop its own estimate. At present, we believe the small commercial poultry industry is the only outlet for feed grains (via mixed feeds). Below the requirements per day are listed:

Layers	42,600 using 10,000 lbs. of feed
Broilers	3,000 using 300 lbs. of feed
Breeders	1,000 using 250 lbs. of feed
Replacements (average)	4,500 using 450 lbs. of feed
Total	11,000 lbs. equals 5.5 tons

Grain (corn) is used for local hog feeding purposes. Very little corn is required for that purpose because of the small size of the swine operations. Total estimated requirement for grains is 4.0 to 4.5 tons per day on a seven day week basis.

GENERAL FINDINGS

NIGERIA

Population

Nigeria has the largest population of any country in Africa, officially estimated to be between 38-40,000,000. Population density varies widely, being the most densely populated around Lagos and in the Eastern region. The overall density is estimated to be between 90-100 per square miles, with a range of less than 25 in some areas of the Northern region to over 250 per square mile in the peanut and cotton producing areas.

General Economy

Nigeria is still a pioneer land with an economy based primarily on the production of raw agricultural materials. In 1960 the Federal Ministry of Information estimated that only 50 per cent of Nigerians were producing for the market, the rest being engaged in subsistence production.

The majority of the population lives in agricultural areas, and some 75 per cent of the adult labor force is engaged in agriculture and forestry. However, the urban population is increasing as a result of a continuous movement into urban areas from rural areas. This movement will be intensified as the educational level increases.

Granting certain limitations, Nigeria has a prosperous and active economy; and almost all economic indicators point to a sustained expansion and growth. Between 1950 and 1957, it is reported by the National Economic Council that the national income increased in real terms at an annual rate of at least 4 per cent per annum. It is expected that future developments in agricultural exports and increased industrialization will accelerate the overall economic growth and development of the national income and improve the general prosperity of Nigeria. However, there are a number of severe economic problems that should be recognized: (1) a shortage of managerial and technically trained workers is evident throughout all sectors of the economy, (2) distances are great and transportation and market facilities are inadequate, (3) electric power supply is insufficient, (4) land clearance is costly, (5) land tenure system, and (6) shortage of both available capital and an adequate credit system for farmers.

Nigeria has large reserves of coal and some petroleum production. In the Northeast, there are large reserves of iron ore. Commercial production will depend on its quality, shipping costs, and the development of a complementary transportation system.

Industry is not yet a major contributor to Nigeria's National Income, and it is only within the past 10 years that industrialization on a factory scale has started to develop. There is some processing of agricultural products; manufacture of cigarettes, beer, and cement; mining of tin, coal, and columbite; together with the development of highways, railways, and electric power.

Agriculture is still the basis of Nigeria's wealth, providing at least 60 per cent of the national income. In addition to supplying some 80-85 per cent of her exports, it also enables Nigeria to feed herself, with foodstuffs accounting for some 80 per cent of Nigeria's present agricultural supply. About 10 per cent of total land area is devoted to field and tree crops annually.

Prospects of increasing the agricultural output of Nigeria are reasonably encouraging. The last decade has seen a development in the internal movement of foodstuffs from surplus to deficit areas. Research has shown how food supplies can be increased through the use of improved varieties, commercial fertilizers, insecticides, and improved methods of storage. The main problem will be to persuade the farmer to adopt the improvements which research has demonstrated are possible.

Some of the major agricultural problems in Nigeria are land tenure, educational level, credit, nutrition, mechanization, transportation, and market facilities. Tenure and credit are critical problems. Credit as a tool to promote improved agricultural practices is almost unheard of. The prevailing tenure system has been a definite deterrent to most permanent improvements and improved agricultural practices.

Recognizing that these basic agricultural problems exist, overall, agriculture still offers, and is likely to remain, the most promising general investment field in Nigeria. The increasing urban population and rising standard of living will raise the effective demand for foodstuffs and should provide the farmer with the incentive to adopt the techniques necessary to increase production and to produce those foodstuffs most in demand

Level of Employment

The latest census of Nigeria (1952-53) gives the following breakdown on the male labor force: (1) about 75 per cent engaged in agriculture or forestry, (2) 6 per cent in trade and commerce, (3) 6 per cent in crafts or industrial work, and (4) 3 per cent in government or professional duties, and (5) 7 per cent other. Although data are not available on the women labor force, it can safely be stated that the per cent engaged in trade is considerably higher than for the number of men and that the great majority of women, as well as men, are engaged in agriculture.

Low limits are set on the quality and efficiency of Nigerian labor by a low literacy rate (12 per cent in the 1952 census) and by a shortage of vitamins in the North and proteins in the South. Another factor having an effect on the technical skills of labor arises through institutional barriers to the mobility of labor.

In 1957-58, out of five children of school age, only one attended primary school and almost nine-tenths of the enrollment is in the Southern part of Nigeria. The percentage of children of school age in secondary schools is still less than 4 per cent, which is considerably below the level needed to supply a nation with skilled manpower needed to adequately develop its resources.

The Nigerian government has a minimum wage scale for an 8-hour day: (1) 5 shillings/10 pence for unskilled (80-85 cents); (2) twelve shillings/6 pence for skilled (\$ 1.75 a day). The national per capita income is less than 30 pounds per annum (About \$ 85 with the rural income, probably not more than \$ 60.00). To supplement this figure, however, over 50 per cent of the agricultural production never enters the cash economy, but represents production for on-farm consumption and local barter.

Transportation and Market Facilities

Nigeria has one of the best developed transportation systems in Africa, but a system which is still highly inadequate for efficient marketing. Transportation both on and off the farm is a critical problem.

Nigeria and the Southern Cameroons have ten customs ports open to ocean-going vessels, with two of these, Lagos and Port Harcourt handling approximately 70 per cent of the exports and 90 per cent of the imports. The facilities at these ports are excellent; Lagos can berth 11 vessels simultaneously; while Port Harcourt is smaller, three new deep-water berths opened there in 1961.

Two important rivers, the Niger and the Benue, comprise the primary inland waterway. The Niger is open to river traffic up to Onitsha (232 miles from the sea) the year round, but above this, the rivers vary considerably in depth depending on the rains. However, during the rainy seasons, the rivers are navigable from 500 to 900 miles inland.

Nigeria has two major railroads with a total of 1,800 miles of tracks. One track originates at Lagos and runs inland to Kano in the Northern Province. Branch lines connect the main line with several of the major agricultural areas in the north as well as with Baro, an interior port on the Niger. The eastern railroad starts at Port Harcourt, runs through Enugu, crosses the Niger at Makurdi, to join up with the western line at Kaduna. A new line is being built to proceed an additional 400 miles to the northeastern corner of Nigeria.

In 1958 there were 37,000 miles of roads of which 4,000 were all-weather hard surfaced. Two-thirds of these are classified as feeder roads. The number of commercial vehicles doubled between 1950 and 1958 with over half of the country's imports moving by truck and about 40 per cent of the exports being moved to port by truck.

Marketing and processing facilities have not kept pace with transportation developments. Market outlets, storage facilities, and processing facilities must all be developed to add stability to the market and to give an incentive to the subsistence farmer to produce for the market.

Also, the national transport system was not designed to move perishable farm products. There are few refrigerated railcars or motor trucks, as well as, very little cold storage capacity

for these products. These problems must be overcome for any development in the fresh protein food trade.

Foreign Trade

Foreign trade is an important contributor to the prosperity of Nigeria. Agricultural products comprise from 85 to 90 per cent of exports, but only about one-sixth of Nigeria's gross national product is derived from exports. Exports more than doubled between 1948 and 1958 in value, and increased about 50 per cent in volume. During the same period, imports quadrupled in value and experienced almost the same growth in volume. The prospects for increasing the wealth of the country and raising the level of the national income rests largely on the possibilities of increasing exports and developing industry.

Imports from dollar areas have required specific import licenses and currency allocations; only wheat flour was on an open general license basis. In 1959, the scope of these general licenses were further enlarged and most goods can be fully imported. However, it remains to be seen what will happen to imported feedstuffs that compete with domestically produced feedstuffs.

Land Tenure and Credit

Land tenure is considered by many authorities to be the major obstacle to agricultural development. Traditionally, land is held communally. This may take many forms, but to clear the title to a piece of land is very difficult. The common concept of land ownership is that it is for the use of the members of the family during their lifetime, but that the members do not have the right of permanent disposal. However, the governments of each region have the right to secure land for the general welfare. Much of the large scale plantation developments are accomplished in this manner.

Credit as a tool to improve agriculture is undeveloped. Most of the private credit in the rural areas is used for subsistence and is extremely expensive. Interest rates are reported in many areas to be 200 to 300 per cent. Much needs to be done in this area.

AGRICULTURAL ECONOMY

Climate and Soils

Climate on the coast in the south is humid, with temperatures rarely exceeding 100° F., with a long dry season from September and October through May.

Nigeria is a large country with wide variations in its rainfall patterns. Rainfall varies from a low of 15 to 20 inches in the far north to over 400 inches on the Cameroon Mountain. Most areas receive from 60 to over 100 inches annually.

Soils are well drained, reddish colored, basically sandy loams, moderately to heavily leached. They generally are of high acidity, especially in the Eastern Region. Fertility varies widely according to the intensity of leaching. With proper management, a larger percentage of the soils of Nigeria could be extensively cropped than could the soils of either Liberia or Sierra Leone. Soil structure, through chemical action, limits continuous cropping in specific areas.

Crop Production

The following information summarizes the basic agricultural situation of Nigeria:

1. About 10 per cent of the total area is devoted to field and tree crops annually. A system of rotation is followed- the land being cultivated for a few years and then left fallow for several years. This is true for nearly all of Nigeria except certain areas in the North. Around Kano, Zaria, and Sokoto, where the soils are somewhat richer and manure is available.
2. Chemical or commercial fertilizers can be used advantageously, especially nitrogen and phosphates, which have shown good results in all parts of the country. These have been sparsely used, however, mostly at research centers and on speciality farms.
3. Statistics on agricultural production are practically non-existent. The annual average increase in agricultural production is believed to be about equal to the annual increase in population. The production of export crops has been increasing much more rapidly than the food crops for domestic consumption.

Additional data sources indicate that Nigeria produces most of its own food and also large surpluses of some crops for export. The chief domestic food crops are cassava, yams, cocoyams,

sorghum, and millet, plantains, corn and sweet potatoes. The chief export or commercial crops are groundnuts, cocoa, palm oil, palm kernals, cotton, and rubber.

In 1956, Nigeria exported over \$ 324,000,000 worth of agricultural products and only imported \$ 38,000,000 worth of foodstuffs. These imports were types of food that Nigeria does not presently produce.

Food consumption per capita is estimated to be in excess of 2,400 calories, of which 1,170 are derived from starchy root crops, 755 from grains, and 220 from vegetable oils. Nigeria has adequate, varied foods to meet its needs, but is short in protein and more especially, in animal proteins. Most food imports are classed as «luxury» and supplemental foods. For example, the consumption of wheat flour is still quite small in spite of imports tripling since 1949.

In 1960, Nigeria imported the following livestock and poultry products:

<i>Item</i>	<i>Dollar Value</i> (<i>Pound valued at \$ 2.80</i>)
Poultry	15,401
Live Animals (food)	3,332
Meat (chilled, frozen, fresh)	1,028,059
Bacon and Ham	105,204
Salt Pork	44,521
Other Meat	29,725
Corned Meat	322,395
Others, canned	332,016
Sausages	299,090
Eggs	351,061
Total Protein Foods (milk, eggs, butter, cheese, fish, meat)	\$ 22,218,994

LIVESTOCK AND POULTRY

Introduction

In the two regions visited, there is great interest in eggs and considerable interest in broilers among governmental circles, as a means of improving the nutritional status of the people. The Premier of the Eastern Region has taken a personal interest in the use of poultry products and their production. The Western Nigerian Development Corporation, a quasi-government agency, is actively interested. In both regions, the Ministry of Agriculture is deeply interested. Eggs and poultry meat are in chronically short supply in the markets. Precise data on the number of birds, etc., are impossible to obtain.

Production of Meat and Eggs

At present there is a total estimated hatchery capacity of approximately 22,000 eggs, or 8,300 chicks per week. On order now are incubators with 34,000 egg capacity in the Western Region and 18,000 proposed in the Eastern Region. This would bring the total capacity to approximately 20,000 chicks per week, assuming 70% hatch of all eggs set. Present hatcheries known to us, are located at Fashula (near Ibadan), Agege, and Abakaliki.

Breeding

Native fowl are frequently of near-bantam size and quite heterogeneous. They lay small or peewee eggs, perhaps fifty per year. Attempts are being made to upbreed by injection of American and European blood lines via males distributed to the Nationals. At the research station at Kajola (Agege) and Abakaliki, Light Sussex and Rhode Island Reds, the latter from the United Kingdom and U.S., are being used as the foundation breeding stock for future commercial production of meat and eggs. Resistance to local diseases appears as good in this imported stock as in the indigenous poultry.

Bird Population

Currently the breeder supply flocks number perhaps 5,000 birds. Since August, 1960, 22,000 additional chicks have been imported, chiefly from the U.K. and Israel for additional breeding stocks. There are practically no broiler chicks in the country. The cockerels are sold as fryers at about 12 weeks age, from the laying flocks. These are sometimes crossbreds produced from Rhode Island Reds crosses on Light Sussex. Commercial egg production is barely started with perhaps six to ten thousand layers in production. Approximately 4,800,000 eggs

will be produced this year in the Western Region according to the Ministry of Agriculture. Next year's estimate is 12,000,000. Replacement flocks are being started in greater number than laying flock numbers would now require, mostly in quantities of 100 to 500 straight run chicks. According to projected plans, approximately forty to fifty thousand laying birds will exist in 1962 with about thirty-five to forty thousand of that number in the Western Region.

Imports

Imports of poultry meats consist of frozen squab broilers from the U.S., cut-up pieces from the U.S., a few ducks, and some turkeys around Christmas time. In 1960 they amounted to only 550 birds per week. This year approximately 20,000 cull and spent layers are shipped per week from the Northern Region into the Eastern Region, with a like number probably going also into the Western Region, although this is not positively known. These Nigerian birds are very poor in market quality. Denmark, Holland, the U.S., and U.K., ship cold storage eggs to Nigeria. Approximately 4.2 million eggs were imported in 1960, or the equivalent of roughly the production of 20,000 commercial layers.

Management

Poultry houses are of gable type with either corrugated galvanized iron roofing or corrugated galvanized iron roofing or corrugated aluminum roofing made locally or thatched roofs. The commercial ones usually have chicken wire of 1" mesh on the sides above locally made cement block walls. Maximum width is 30 feet and length may be up to about 150 feet. Layers are held either in stair-step cages with two birds per 12" cage or on litter. Incidentally, most of the cages come from Israel. Wooden trough feeders are used. Small hand waterers are used. In some areas, houses are ringed by a moat filled with water to repel warrior ants. There is some feed wastage. Sick birds are kept with healthy ones and multiple age rearing is common. Litter is replaced between groups. It is usually wood shavings.

Diseases

Pullorum is reported to be no problem. The veterinary profession requires a D.V.M. be employed to perform vaccination of poultry. In the Eastern Region birds are being vaccinated at eight weeks against Newcastle and fowl typhoid, against fowl pox at ten weeks, and fowl cholera at twelve weeks. There is no charge to the farmer. C.R.D., the worst plague of the U.S. poultry industry, is no problem in Nigeria yet. The Western Region poultry specialist believes he has seen Fowl Coryza. A.D.V.M., Dr. Kaschula, trained at Rutgers, is coming to provide the services of a specialized poultry pathologist. I believe there are two other D.V.M.'s capable of handling this type of work in Nigeria. The vaccines are available from the U.K. Pfizer is here with supplies of feed grade Terramycin.

Supervision

The caliber of the expatriate supervision appears good. The Nationals appear also to be of good caliber. We were impressed by the operations of the U.S.O.M. in this country. The extension work seems to be excellent although quite limited by a shortage of trained personnel.

Marketing

Processing and egg handling are in a rudimentary stage.

Feed Supplies

This is a country which has some of the necessary feed supplies for the support of a livestock industry. It has ample supplies of groundnut meal (peanut meal), of rather good quality, and as a matter of fact, exported 53,270 tons of this ingredient in 1960. It has seasonal supplies of yellow corn and grain sorghums. The supplies are considered to be quite adequate by the Nationals, who are unfamiliar with the demands of a modern feed industry once in large scale production. There is a serious problem with weevils and grain mite infestations which could be controlled by modern storage methods.

Feed Ingredients

Nigeria is believed to be self-sufficient in grains and vegetable supplements by its officials. The Northern Region produces Guinea Corn (milo), blood meal, and ground nut cake. Maize (corn) is also supplied from the North and is grown in the Eastern and Western Regions, too.

They have to import the fish meal. White corn is competitively used by human beings. It is produced in large quantities within Nigeria, but in quantity only sufficient to directly feed the human population. The country has two crops of maize (corn) - July and November through December. Guinea corn (milo) is produced from Christmas through January and February. Nigeria lacks at present fish meal and alfalfa meal or equivalents. It also has no meat scrap or soybean oil meal. It does have blood meal and rice bran. It also will shortly have about 20 to 25 thousand tons of flour mill by-products. We are uncertain about indigenous phosphorous and calcium supplies, but believe they are locally available. Peanut meal, of course, is the basic protein supplement available. There is no import duty on grains.

As an illustration of the effect of feast or famine condition on ingredient prices a table below is included:

<i>Ingredient</i>	<i>Price per Short Ton</i>	
	<i>Low</i>	<i>High</i>
Maize (corn)	\$ 50	\$ 102
Guinea corn (milo)	55	76
Blood meal	102	121
Ground nut cake (peanut meal)		
(Excluding freight from Northern Region)	50	?
White fish meal	136 (from U.K.)	196 (Israel)

Several years ago, Mexican 5, a flint yellow corn, was introduced here. It is not liked by Nationals who prefer white corn for their food so it is available in limited quantities for feed use for the livestock industry. There is at Bahalin a rice mill, the owners of which are interested in poultry as a method of using the by-products, according to rumor. The Southern Stores Shipping Company, New York, is committed to set up some pilot farms aimed primarily at cattle production to utilize by-products of, we believe, the flour mill. In the Eastern Region there is production of rice bran at Abakaliki and two other locations within the region.

It is the opinion of the survey team that grain supplies are inadequate to supply a poultry industry and deficiencies in the vegetable protein available will also require importation of some other protein sources, animal and vegetable.

Manufactured Feeds

There are no commercial companies manufacturing feeds at present in Nigeria. The Nigerian government (Western Region Government) is currently mixing it for their more advanced farmers. At present, the government states it is manufacturing this month 250 tons and expects the volume will increase to a rate of 300 tons by the end of the year within the Western Region.

The Eastern Region Government claims it is manufacturing this month approximately 42 tons and last month made 12 to 13 tons, mostly poultry feed. Feed officials anticipate it will reach 110 tons per month next year. In the Northern Region the feed manufacturing situation is not clear, but we believe it consists primarily of crude mixes for a huge 32,000 head per year hog farm, including about 3200 breeding sows. On the rough assumption that each hog consumed 75 pounds of manufactured feed, this should amount to approximately 100 tons per month. Aside from the Northern Region, these statements of requirement cannot be explained on the basis of existing commercial farmers made known to the survey team. To inquiries directed separately to the Ministry of Agriculture for the Western Region, Mr. Wilder of the ICA attached to the Livestock Division and the man in charge of actually mixing the feed at the Food Depot at Agege (in the Western Region) all cited the same answers. The figure for the Eastern Region is that furnished by ICA Poultry Extension man, Charles Davis, at Abakaliki, and on those of his National counterpart, Mr. Orok. Obviously, a major portion of the total manufactured feed supplies must in this initial stage be going to numerous small customers. Probably an average of about 150 to 175 tons of mixed feeds, mostly poultry, are being produced currently. It is, of course, in mash form and appears to be of understandably modest quality. The government representatives state they are only mixing feed because there is no one else at present willing to do so.

There is usually a general purpose feed which may be used for dairy, livestock, and growing birds. There is also a starting chick diet and layer-breeder diet. Mixed feeds are not imported.

Incidentally, there are no trade barriers at present between the three regions.

Feed prices are subsidized. Poultry laying feed costs about \$ 81 per short ton. Chick starting feeds, unmedicated, cost about \$ 90 and medicated about \$ 101 per short ton in the Eastern Region. The price does not cover mixing and grinding or labor costs. In the Eastern Region, cost per short ton of laying feeds exclusive of freight and mixing and grinding and labor is about \$ 83. Feed is frequently sold by the pound at about 4.5¢.

It is planned to distribute feed from three mixing stations at Benin, Ibadan, and Agege in the Western Region and three storage points in the Eastern Region.

At Agege in the Western Region, feed is prepared now with a 1100 pound capacity mixer and a 550 pound per hour capacity grinder with a 5 h.p. motor. Milling facilities at the other two points are, I suspect, more primitive, but were not visited by our team. In the Eastern Region, only a grinder is used and final mixes are prepared with shovels and hoes.

Because of lack of available commercial mixing, the government of the Western Region is importing three mills, grinder-mixer type, with a capacity of one ton per hour each from Israel.

Storage Facilities

There are at present no finished product storage facilities. Ingredients and finished feeds are handled in bags. There is a feast or famine situation on grain due to lack of storage facilities and insect control problems. Tibbutt, the American agronomist located at Ibadan, estimates there would be a 2 to 3 per cent increase in corn and milo production annually, except there could be an apparent larger increase initially if proper storage facilities were provided.

At the ports of Lagos and Port Harcourt, ingredients or manufactured feeds could be handled. At present, bulk handling facilities are not available at either port. One special problem exists. During the rainy season, unloading and loading of feeds and feedstuffs will present special problems. Rains are sometimes torrential and both feedstuffs and foodstuffs must be adequately protected.

Feed Requirements

At present the estimated average requirement is 150 to 275 tons per month. In 1962, because of the rapid increase in the poultry industry anticipated by the Eastern and Western Region Ministers of Agriculture, between 300 to 400 tons per month will be necessary.

On an annual basis, next year's anticipated feed usage would require a feed grain supply of approximately 3,000 tons in Nigeria. It is doubtful if more than 1500 tons at best can be obtained within the country. While the quantities of grain and mixed feeds involved are small in terms of U.S. experience, they are vital to this «Operation Boot Strap», development of commercial poultry industry.

GENERAL FINDINGS

SIERRA LEONE

Population

The population was an estimated 2.1 million in 1956. Freetown, the capital, has a population of approximately 90,000. The government estimates that population in the colony area around Freetown is increasing at an annual rate of ½ per cent and in the Protectorate at 2 per cent. Overall population density is about 75 persons per square mile.

General Economy

Mining and agriculture make up Sierra Leone's economy. Most of the mining activity is concentrated in diamonds; a smaller share in iron ore mining. The pound value of diamonds exported in 1960 was 16,482,436 pounds (\$ 46,151,000) and for iron ore it was 4,135,405 pounds (\$ 11,579,134). It is generally conceded that the value of diamonds exported is above the quota statistics because of the black market trade in diamonds. Sierra Leone has attempted to reduce the black market trade in diamonds by raising the market price of diamonds to a competitive level. As a result, the diamond area in the Kenema region has shown some increased economic activity in recent months. During 1960 the balance of trade for Sierra Leone was slightly unfavorable with imports exceeding exports by 415,412 pounds. It is estimated that if all dia-

monds had moved through official channels that the balance of trade would have been favorable.

The agricultural economy of Sierra Leone is based primarily on a subsistence level of output. Most indigenous Sierra Leoneans cultivate small upland farms of two or three acres, using the same crude hand tools common to most African farmers. Indigenous Sierra Leoneans hold and cultivate land under tribal law customs. Non-Africans may rent land for a term not exceeding 50 years, renewable for additional terms not exceeding 21 years.

Most of the export crops are grown on the farms of larger acreage or on speciality plantations. The domestic food crops of rice, cassava, palm oil, millet, sorghum, and sweet potatoes are normally produced on the small acreages of the indigenous farmer. Food production is barely adequate with a «hungry season» coming just before the rice harvest. Under the guidance of the government, the country had reached self-sufficiency in rice production, the main food, until the economy was upset in the mid-1950's by widespread illicit diamond prospecting. At the present time, Sierra Leone is an importer of rice, having imported 28,000 long tons in 1960.

Basic data indicate that Sierra Leone has undergone a rather rapid economic growth since 1948-49. However, at present the economy is tending to go through a re-adjustment period similar to a leveling off or a breath-catching phase in its growth. During this period, as evidenced by Sierra Leone's growing economy, the national budget has increased as follows:

<i>Year</i>	<i>Pound Amount</i>
1939	900,000
1949	2,000,000
1955	4-5,000,000
1960	11-12,000,000

A prominent business official expressed a more pessimistic outlook regarding the economic potential of Sierra Leone. In contrast to large amounts of foreign investments pouring into Liberia to develop the iron ore reserves in this country, he foresees nothing in the near future to cause such capital investment in Sierra Leone. He believes that future economic development in Sierra Leone will be slow and basically related to the development of its agricultural resources.

The government of Sierra Leone realizes that any expansion in its economic well-being is closely related to the future development of its natural resources, especially in the fields of agriculture, forestry, and fisheries. The government believes that if they are to raise the general level of living of the country, above the present subsistence level for the majority of its people, that greater emphasis must be placed on production, marketing, and storage programs related to the development of these resources.

By embarking upon an overall program related to production, marketing, processing, and storage, it will be possible to speed up the adoption by subsistence farmers of improved and up-to-date farming methods. Thus, by creating conditions in which primary producers can enjoy an increasingly higher standard of living, the general level of prosperity of the whole country can be raised. The ultimate objective of the government's participation in this program is to make these occupations financially rewarding enough so that the present attraction of «white collar» work or diamond mining will be diminished. It is hoped to substantially raise the purchasing power of the subsistence farmer, and fisherman, and, thus, their standard of living.

The government has four main long-range objectives as related to agriculture: (1) cultivation of rice in reclaimed river and coastal swamps, (2) encouragement of mechanical cultivation, (3) improvement of the oil palm industry by the introduction of higher-yielding varieties and by the use of better oil extraction methods, and (4) increased coffee production. And more recently, the 1961 budget provided 10,000 pounds (\$28,000) to develop the poultry industry of Sierra Leone. This money is earmarked to provide for the establishment of a demonstration flock, one in each province.

In the past, the Department of Agriculture has confined its activities to research and advisory services. It now feels that this work must be continued and expanded, that much more time and money must be spent on direct supervision of the overall productive effort. The effect of much of the work in the past has been nullified because of the farmer's lack of capital, lack of know-how, and lack of incentive to produce more efficiently because of an inefficient pricing and marketing system.

To combat the shortage in the overall technical know-how of the farm population, the government is stressing the training of extension workers. It is proposed by the government in

cooperation with the International Cooperation Administration (ICA) to develop throughout the country several Rural Training Institutes. Practical courses covering all phases of production, marketing, and rural life are planned.

The new government of Sierra Leone gives every indication of pursuing a policy of vigorous development in the field of natural resources, by encouraging local agriculture, fisheries and forestry, and by extending a welcoming hand to foreign investors in sectors where such investment is needed. Government's two main aims are self-sufficiency whenever possible and the expansion of export surpluses. It intends to achieve these aims by providing more capital, more extension services, and suitable marketing facilities.

The primary objective of the government is a «grass-roots» program aimed to improve the lot of the primary producer, and by so doing, to raise significantly the general standard of living throughout Sierra Leone.

Level of Employment

As is common to all the countries of Africa visited by the market survey team, one of the major economic problems of Sierra Leone is that of human development. While advanced above the educational level of Liberia, there is still a shortage of trained manpower with the technical skills needed to form the foundation for a strong economic growth in Sierra Leone.

Out of an estimated population of slightly over 2 million, probably not more than the families of 40-45,000 are in the money economy, with 5,000 of these being non-Africans. Thus, approximately 90 per cent of the total population is still at a subsistence level of living; and in general, because there has not been any coordinated effort to develop the agriculture of the country, it is primarily a subsistence economy.

The average per capita income is estimated to be approximately \$ 55 a year. The local wage in Freetown is about 5 shillings (70 cents) for unskilled and 10-11 shillings (\$ 1.40 - \$ 1.54) per day for skilled workers. Wage rates are somewhat lower in the interior areas except possibly in the mining areas. Data indicate a growing middle class in Sierra Leone. In 1960, 2,658 people paid income taxes which started at a base of 400 pounds.

Sierra Leone has stressed education, although to a limited degree, and has a better developed educational program than many other African nations. It has a local college (Fourah Bay College, The University College of Sierra Leone) that is currently increasing its facilities. Graduates of the Sierra Leone educational system can be found in many West African nations, primarily fulfilling the need of a trained civil servant group in these countries.

Transportation and Market Facilities

The port at Freetown is one of the better natural ports in Africa. It has adequate dock and warehouse space and although over 1300 vessels called on the port in 1960, it is relatively empty at most times. However, at the present there are no facilities for the handling of bulk grain and present warehouses are inadequate to handle anything except sacked feedstuffs.

The internal transportation system is not adequate or efficient. Although Sierra Leone has developed some major roads, the various areas are still too isolated for the efficient movement of products. There are a few feeder roads and no farm-to-market roads to tie the rural areas into the developed roads at present. In addition, there is only one narrow gauge railroad that penetrates any distance into the interior.

A major transport problem, relative to the development of a mixed feed or feed grains mixing program in the Free Port at Monrovia, is the lack of adequate coastal shipping. At the present time, French vessels call on French territories, English on English territories, and so forth. Thus, coastal shipping would have to be improved if Sierra Leone was to secure a dependable supply of feedstuffs from the Free Port area in Monrovia.

The market facilities for handling either feedstuffs or poultry and poultry products at present is wholly inefficient. These areas must receive attention if any growth and development in the country's economy is to take place.

Land, Tenure and Credit

These two items together with a shortage of trained personnel are major deterrents to any widespread agricultural development program.

Africans hold and cultivate land under tribal laws and customs. Land tenure is one of the major drawbacks to establishing any form of commercial agriculture and the credit system necessary for its development. The government of Sierra Leone realizes this difficulty and has

requested the United Nations Technical Assistance Board to provide an expert on land tenure to examine this whole problem and make recommendations.

AGRICULTURAL ECONOMY

Climate and Soils

The climate of Sierra Leone is equatorial with the wet season lasting from mid-April to mid-November. Average rainfall varies from 75 to 130 inches a year. Along the coast, some areas report up to 300 inches a year. The soils are basically a very porous sandy clay loam and highly leached. The basic soil condition together with the heavy rainfall makes Sierra Leone best adapted to a tree crop system of agriculture.

Crop. Production

Sierra Leone is slightly smaller than South Carolina. Between 50-60 per cent of its land area is currently used for cropping or for tree crops, with about a third devoted to pasture, and the rest used for other purposes.

Rice, cassava, palm oil, millet and sorghum, and sweet potatoes are the chief crops grown for domestic foods. Export crops are palm kernels, coffee, cocoa, piassava (palm fiber), kola nuts and ginger.

Food production is barely adequate, with a «hungry season» coming just before the rice harvest during the fall or early winter. Available statistics on the level of nutrition are very poor. It is estimated that the caloric intake usually is not far from basic requirements, but the quality is unsatisfactory, low in proteins, especially animal proteins, and low in minerals and vitamins.

Sierra Leone is a net importer of food, and it is apparent that the domestic food production is not keeping pace with the population growth. In 1957 the imports of foods, beverages, and tobacco was approximately \$ 14.8 million and this figure had increased to \$ 17.3 in 1960. Rice, beer, sugar, and wheat flour are the leading items imported, on a cost basis.

The production of feed crops in Sierra Leone is practically nil. Although millet and grain sorghums are produced, the competition for foodstuffs is so great that these products are used for human consumption. In 1960 over \$ 53,000 worth of feedstuffs, not including unmilled cereals, were imported.

LIVESTOCK AND POULTRY

Introduction

If livestock production is just born in Liberia, it is still a gleam in the eye in Sierra Leone. However, there is a great deal of interest in it, particularly in regard to poultry.

Existing Production of Meat and Eggs

There is at present an incubator capacity of 5300 eggs per week in the country located at the government Experiment Station at Newton. At this station, European type breeding is maintained and used as a germ stock for improvement of indigenous birds. It consists of Rhode Island Red, New Hampshires, Barred Plymouth Rocks, Light Sussex, Thumber 505 (probably Hy-Line) and also some crossbreds which are Golden Legbar Crosses. The Thumber 505's are performing excellently. The only drawback is the relatively low salvage value which is the chief argument in favor of the dual purpose birds. Most of the birds in use in semi-commercial flocks at the present time are dual purpose ones. The unusually high salvage value of spent layers makes the use of such birds possibly wise at this time.

There are approximately 5150 commercial layers at present, and probably 3,000 replacement birds. A number of producers are stated to be planning to double the size of their operation as soon as a reliable source of feed can be located; the egg and poultry meat markets are highly profitable at today's prices. One grower is reported to be planning to produce 500 broilers per week. Total production hoped for next year is 22,300 layers and 5,000 broilers among members of the local poultry association. This association was organized under government leadership and includes as members all commercial poultrymen.

There are no broilers at present; spent layers, and by-product cockerels represent the total meat production. Six years ago, there was no local commercial egg production and no sale of eggs on a commercial scale. Today, 800 dozen per month of locally produced eggs are sold. In 1958, local production of eggs represented one-third of imports. In spite of increased pro-

duction, in 1959 local production accounted for only 10% of the total egg sales, with the rest being imported. Ninety-three hundred dozen are imported per month. This is an estimate. That is only equivalent to approximately 6200 commercial layers, in high production.

Most poultry meat is imported from the United States, with some coming also from Europe. Quantities are small.

Management

Poultry housing is nondescript, mostly of poor quality American type. Buildings are relatively small, sanitation is poor, little is known of modern drugs. Birds of European and American breeding, vaccinated against Newcastle, do as well from a livability standpoint as indigenous stock and better in other ways. Nationals are anxious for such stock, even in the bush.

Commercial birds are vaccinated with Lederle's Wing Web Type Vaccine against Newcastle three times to maturity and once against fowl pox. This is done gratis by the government veterinary service. There are four or five veterinarians in the country. A well-thought of one is Mike Thomas, trained in the U.S.. He is a government officer who is reported to diagnose well but to have poor laboratory equipment. There is really no modern supervision of the birds provided.

Feed Supplies

Some ingredients are locally available. A «basic» feed mixture of quite deficient quality is manufactured by the rice mill at Clinetown. This mix is used directly by some producers but also is further fortified by the government station at Newton which makes it into a rudimentarily satisfactory poultry feed for layers and for growing birds. Feed ingredients of local sources are rice bran, broken rice and maize. There is very little of the latter. Ground nut (peanut meal) is imported from Nigeria at a cost of \$ 100.00 per short ton. Fish meal at \$ 127.00 per short ton is imported from the U.K. Barley has come recently from Iraq at a price of \$ 62.00 per short ton. Some maize is imported from the U.K. at \$ 68.00 per short ton. The rice mill general purpose mix is sold at \$ 2.80 per cwt. (112 lbs.), or approximately \$ 50 per ton. Minerals, vitamins, or fish meal are added only on special order.

At present there are no restrictions on imports of ingredients or mixed feeds and standards for such products are virtually non-existent. The rice mill has a one ton per hour capacity mixer. The government has one of about the same capacity, or less. It sells its feed for \$ 3.50 per cwt., or \$ 62.00 per ton. Total consumption of mixed feeds is believed to be about one ton per day, mostly of laying type with a little hog feed and some poultry growing feed. Quality is poor. Besides the rice mill and the Newton Station, one poultry grower named Courban acts as a distributor for a European commercially manufactured feed. There is talk of the establishment of a flour mill tied in unofficially with Pillsbury.

There is no modern wharfage, but a good harbor at Freetown. There is a narrow gauge railroad bisecting the country. There are about 3,000 miles of graded roads (twice as much as in Liberia). All feed supplies would have to be handled in bags. Extremely heavy rainfall occurs during the rainy season and special precautions would have to be necessary in the handling of feeds and feedstuffs during that period. There are no bulk facilities. We saw no cranes or other loading devices.

There is great interest in the provision of better quality feeds and local manufacturing. It is my impression that the country is determined to increase its poultry production. The total size of the operation is inconsequential by American standards. However, it is extremely important to Sierra Leone. It is possible that the decisions taken concerning help for them in obtaining reliable and adequate supplies of ingredients and manufactured feeds may have an important bearing on future relations between that country and our own. This would be out of all proportion to the actual financial involvement. At the present time, Sierra Leone is a relatively peaceful, tranquil, newly freed country, a member of the British Commonwealth. Our relations with both the English and the Nationals there are apparently quite satisfactory. There is a natural inclination reported in Sierra Leone to regard the world as divided between Great Britain and America rather than between the West and Russia. They are looking to America as a mentor at the moment.

It is estimated that the total feed requirement for Sierra Leone is no more than approximately one ton per day at present. The future more adequate nourishment of their people depends on the development of the livestock industry to a considerable extent. This tonnage of feed is absolutely necessary and it must be a dependable, reliable one, if their program of development is to succeed.

GENERAL SUMMARY

In visiting the three countries of Sierra Leone, Nigeria, and Liberia, we found that they share a great and growing interest in poultry meat and eggs as a major part of their program of correcting the present dietary imbalances within their population. They feel in each case, and we think they are correct, that the erratic, unreliable, and variable quality supplies of feeds and feedstuffs have been a major obstacle in the past and at present. They are each interested in the establishment of mixing facilities within their own country. In fact, in Nigeria both the Eastern Region and the Western Region want mixing facilities in their own area and while we did not visit the Northern Region, that also probably is their feeling. They are considering at present the establishment of such mixing facilities by their local, regional or national governments. Since there is much more involved in this than simply the manufacture of feed itself, and they also are relatively uninformed concerning formulation question, they would all prefer at this time that this job be turned over to an interested commercial feed company. In each country, they felt there were possibilities of using local ingredients. We think that is true in Nigeria, but to a much lesser extent in the other two countries. Even in Nigeria, there is an inadequate supply of grain. It is adequate at certain times of the year; actually, the grain supplies are competitively used by humans. It seems evident that any expansion of the poultry industry must await a reliable supply of manufactured feeds of satisfactory quality. These manufactured feeds, in order to have satisfactory quality and price, must utilize external sources of feed grains.

If we are thinking in terms of American feedstuff volumes or even European volumes, these countries offer little of interest at present. If we are thinking from the standpoint of pioneering, of helping these people, these countries offer an immensely challenging and rewarding experience, followed in the long run, particularly in Nigeria and to a somewhat less extent in Liberia and Sierra Leone, by possible commercially interesting opportunities. At present, the volume of mixed feeds required in any one of these countries is inadequate to satisfactorily support feed mixing facilities. Nigeria would come closest to meeting this needed volume with Liberia second and Sierra Leone third. Possibly, manufactured feed could be delivered to the Free Port in Liberia and trans-shipped from there to Freetown, Sierra Leone. It is our judgement that in the long run, Nigeria will furnish an expanding market for manufactured feeds and for feed grains.

At the present time, it would be unprofitable for any commercial company to establish mixing facilities in any of these countries. At least it would be unprofitable from the short-term sense. However, the skill and know-how of a well qualified American commercial feed manufacturing firm can provide tremendous assistance to the developing livestock and poultry industries in these nations. The big job will not be satisfactorily handled through the provision of feeds and feedstuffs alone. With that must go up-to-date efficient supervision and training of the nationals, knowledge of most effective medicines, vaccines, breeding, processing, marketing, storage, money management, etc. American firms possess this knowledge and ability and a way needs to be found to interest such firms in helping in these countries.

STABILIMENTO TIPOGRAFICO
LUIGI AMBROSINI
Roma - Via Annia, 54
